

Introductory Remarks

A COMPILATION OF SHEAR WAVE VELOCITIES AND BOREHOLE GEOPHYSICAL LOGS IN UNCONSOLIDATED SEDIMENTS OF THE FRASER RIVER DELTA, BRITISH COLUMBIA.

by

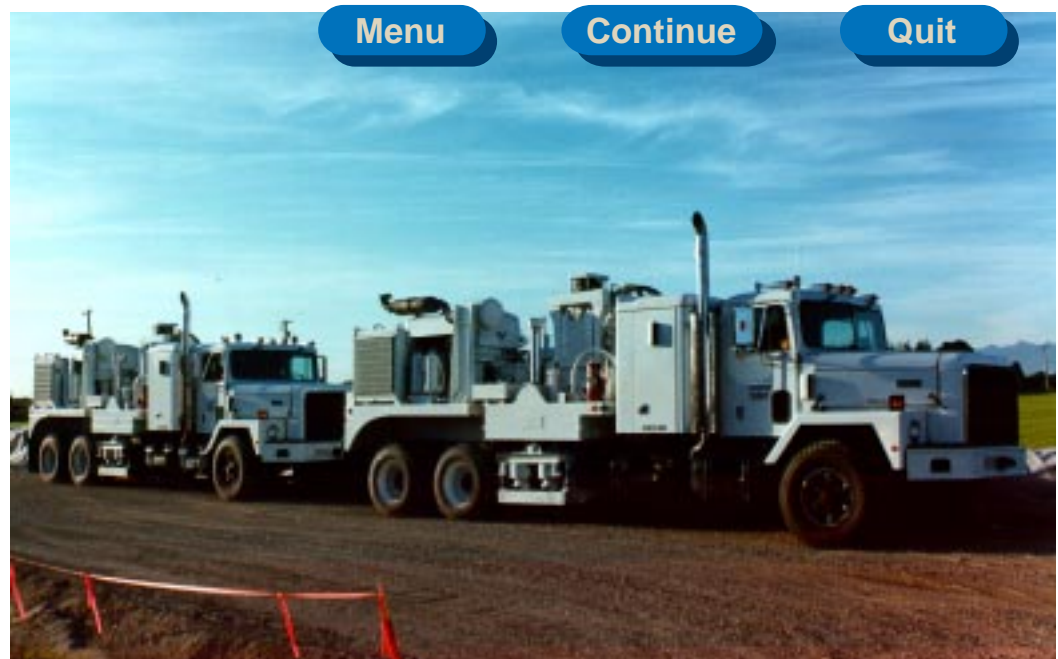
J.A. Hunter, R.A. Burns, R.L. Good, C.F. Pelletier,

(with contributions by J.R. Britton, H. A. Christian, S.R. Dallimore, M. Douma, J.B. Harris,
J. L. Luternauer, P.A. Monahan, K.G. Neave, M.C. Roberts, D.J. Woeller)

INTRODUCTION

Since 1985, the Geological Survey of Canada has conducted surface and borehole geophysical testing in the Fraser River Delta in order to delineate and characterize subsurface Quaternary materials as an aid to regional earthquake hazard studies. The work is currently conducted as part of the GSC "West Coast Hazards" Project #950029. Such geophysical work has included the application and interpretation of seismic reflection and refraction techniques as well as borehole measurements, and constitutes one portion of the geoscientific studies currently being conducted by federal, provincial, university, and industry research teams. The reader is referred to GSC Bulletin 525 "Geology and Natural Hazards of the Fraser River Delta, British Columbia" (1998) edited by J.J. Clague, J.L. Luternauer, and D.C. Mosher for a complete summary of current geoscientific knowledge of the area.

[To see the surficial geology map of the Fraser River delta (after Armstrong, 1984), click on [Surficial Geology Map](#).]



Vibroseis seismic sources used to obtain deep seismic reflection data in the Fraser Delta (see Dynamic Oil seismic lines in methods section).

It has become apparent that the thick unconsolidated sediments of the Fraser River delta may be responsible for modifying the ground response to earthquake shaking through amplification and resonance of incident teleseismic earthquake waves; such effects may lead to large horizontal ground accelerations over limited seismic frequencies as well as the possibility of seismic liquefaction of near-surface water-saturated non-cohesive sediments. These effects are strongly dependent on the vertical and horizontal variations of shear wave velocity structure within the unconsolidated Quaternary sediments.

Hence, the Geological Survey of Canada has compiled all available GSC shear wave velocity data in the delta, along with other ancillary geophysical data in the form of this CD-ROM in order to provide an overview of velocity structure as a guide for geotechnical engineers and earthquake modellers.

Although an attempt has been made to obtain subsurface shear wave velocity data on a regional scale, the reader will note that coverage is currently far from uniform, and future GSC research will be directed towards filling some of the “voids” and examining geophysical structural anomalies in more detail.

USING ACROBAT READER

In the following text, the user will find a brief description of the various components of this database and how to access them on the CD-ROM.

All the active documentation available is in PDF format (Portable Document Format) and can be accessed using Acrobat Reader. To get a good idea of the potential of that program and about the material given out on the CD-ROM, have a look to the Tutorial. The Tutorial can be reached from the first page of the main document by clicking on the TUTORIAL button. This will open a different application which will navigates you through the different sections of the CD ROM.

As well, reading the following text will gave the user an overview of the GSC geophysical database, and how to access it on the CD-ROM.

THE GSC GEOPHYSICAL DATABASE

The geophysical database is subdivided into three categories in the Table of Contents (Figure 1):

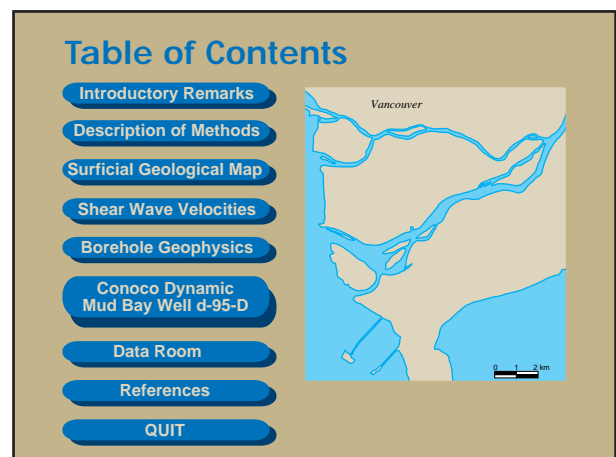


Figure 1. Table of content as shown in the Acrobat Reader document.

Menu

Quit

I - SHEAR WAVE VELOCITIES:

The shear wave velocities have been measured using:

- surface refraction sounding techniques
- surface to borehole logging techniques
- seismic cone penetrometer techniques
- velocity analyses of conventional seismic data (Dynamic Oil Co.) using an empirical compressional-shear wave velocity relationship.

Clicking on SHEAR WAVE VELOCITIES in the Table of Contents brings up a location map with each of the four data sets mentioned above, along with a menu button for each data set (Figure 2).

The ZOOM icon located in the Acrobat Reader tool bar can be used to examine the locations of the data points in detail, but mouse-point access to individual data plots is not possible on this map due to overlapping data sets.

Upon selecting a particular data set, a map showing the data locations is displayed (Figure 3).

From each data set map, or from the Table of Contents, a detailed explanation of the geophysical methodology can be obtained.

By clicking on any of the survey site shown on one of these particular data set maps, the velocity depth plots specific to that site will be open. Where survey sites are close together it is recommended that the ZOOM feature be used to expand the portion of the map of interest (Figure 4). Zooming part of the map will also enhance the background road grid system allowing the user who is familiar with the area to orient the data point location with respect to major road grid features.

Note that the UTM NAD-27 map coordinates of the survey site are also printed on the velocity-depth

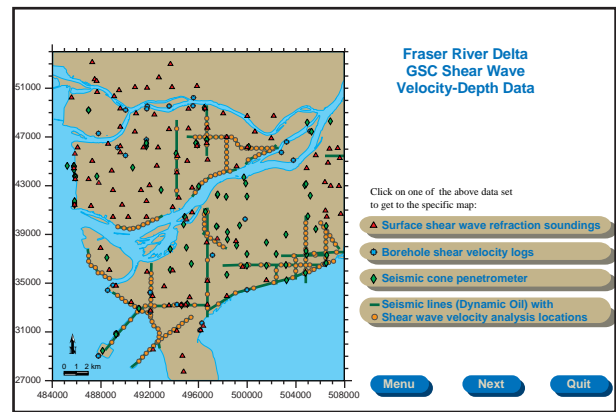


Figure 2. Location map, from which any of the four data set could be reached by displaying their site locations.

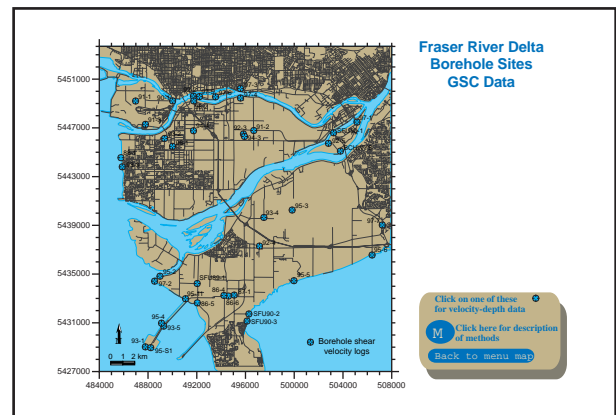


Figure 3. An overview of the Borehole survey sites location map. By using the zoom tool, the user can get a closer look as shown in figure 4.

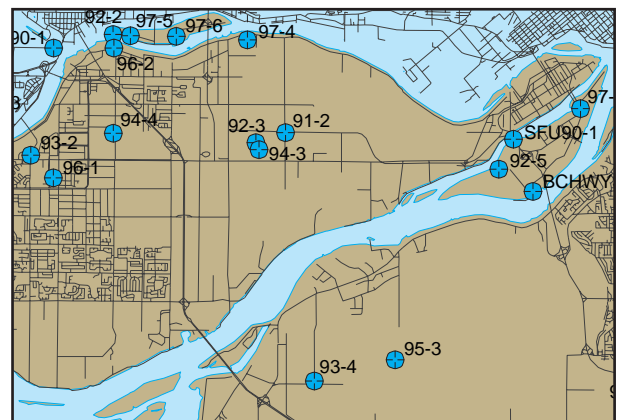


Figure 4. A zoom in of the previous map, showing some of the sites which are active links to the graphic.

plot; and that ASCII UTM data location files can be found in DATAROOM directory on the CD-ROM .

Hardcopy printouts of maps and data plots can be obtained at all times by selecting the PRINT feature located under the FILE menu in ACROBAT READER.

II - BOREHOLE GEOPHYSICS LOGS

NATURAL GAMMA, ELECTRICAL CONDUCTIVITY and MAGNETIC SUSCEPTIBILITY data have been obtained in GSC boreholes in the delta using the GEONICS EM-39 logging system.

By going to the Table of Contents and clicking on BOREHOLE GEOPHYSICS LOGS, a location map of boreholes survey sites is presented. A detailed description of the logging procedures can be obtained by clicking on the METHODS button

By clicking on a site location on the map, a graphic combining depth plots of NATURAL GAMMA, ELECTRICAL CONDUCTIVITY, MAGNETIC SUSCEPTIBILITY along with GENERALIZED GEOLOGY can be obtained.

III - CONOCO-DYNAMIC MUD BAY WELL d-95-D

Clicking on CONOCO-DYNAMIC MUD BAY WELL d-95-D button in the Table of Contents brings the user to a GSC report describing electrical induction and seismic logs from a well drilled through the Quaternary sediments and into the Tertiary bedrock in the south-eastern portion of the delta.

To date, this is the only known hydrocarbon exploration well in the delta with continuous geophysical logs from surface down to Tertiary bedrock; the geophysical contrasts shown in this report (i.e. the Holocene-Pleistocene and Pleistocene-Tertiary boundaries) are noteworthy for earthquake modellers.

Note that digital data for the electrical and seismic logs can be obtained in the DATAROOM directory as indicated on the plots.

ACCESS TO DIGITAL GEOPHYSICAL DATA SETS

A listing of the ASCII data file name and file directory information in the DATAROOM main directory is given on each of the geophysical data plots. To access and/or copy the data file, the user must first exit ACROBAT READER, since it is not possible to open a data file from this application. Hence, it is recommended that the user manually notes or prints a hard copy

DATAROOM contents:

- Borehole
- Dynlines
- Geophysic
- SCPT
- Surref
- Mudbay
- UTMcoor

of each plot for data file reference information, especially if several different plots and locations are to be accessed.

Although editorial proof-reading of maps, plots and ASCII files has been attempted, inevitably such a compilation will not be error-free. It would be appreciated if such errors could be brought to the attention of:

J.A. Hunter
Geological Survey of Canada
601 Booth St.
Ottawa, Ontario, Canada,
K1A 0E8
Tel: (613) 992-2560
Fax: (613) 992-2468
E-mail: jhunter@gsc.nrcan.gc.ca

